REMARKS

Claims 1-11 and 28 are pending in the present application. Claims 1-11 and 28 have been rejected. Claims 12-27 have been withdrawn in accordance with the election to prosecute Claims 1-11 made in the Amendment and Response to Office Action filed on October 28, 2002. Reconsideration and allowance is respectfully requested in view of the amendments and the following remarks.

The 35 U.S.C. § 103 Rejections

Claims 3-5 and 8-10 stand rejected under 35 U.S.C. § 103 as being allegedly unpatentable over Ozmat (U.S. Patent No. 6,196,307 B1) in view of Galloway (U.S. Patent No. 5,322,116) as applied to Claims 1 and 6, in view of Saito et al. (U.S. Patent No. 6,361,857B1) or Herb et al. (U.S. Patent No. 5,316,842). This rejection is respectfully traversed.

Examiner's Rejection

In the Office Action, the Examiner states that the Ozmat reference does not disclose a non-metallic framework material substrate. The Office Action asserts that the Galloway reference discloses a ceramic foam being highly porous to allow the gas to flow along the edge portion with relatively low flow resistance. The Examiner contends that it would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the metallic foam by the ceramic foam, as taught in the

Galloway reference, motivated by the desire to obtain the heat exchanger that is relatively lightweight, strong and well suited to withstand the thermal cycling of the system.

In the Office Action, the Examiner also states that the Ozmat reference is silent as to a thickness of the diamond and surface roughness of the diamond. The Examiner also states that the Saito et al. reference teaches the diamond having a thickness of 24 microns and the Herb et al. reference discloses the diamond having a thickness of 25 microns. The Examiner contends that such a variable would have been recognized by one skilled in the art to economize the cost of the production and control the degree of the adherence between the thin diamond layer and the substrate with the minimized warping effect. As such, the Examiner contends, in the absence of unexpected results, it would have been obvious to one having ordinary skill in the art at the time the invention was made to employ the diamond having a thickness instantly claimed since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

In the Office Action, the Examiner contends, with regard to Claims 5 and 10, that the coalescence of the diamond film would have been inherently present in the heat exchanger.

Lastly, in the Office Action, the Examiner contends, with regard to Claim 11, that in the absence of unexpected results, it would have been obvious to one having ordinary skill in the art at the time the invention was made to employ the foam having a porosity claimed since it has been held that where the general conditions of a claim are disclosed

in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Applicants respectfully disagree with all the Examiner's contentions.

Cited Art

The Ozmat reference discloses a metal foam heat exchanger for direct bonding to an electronic module. The metal foam is a network of metal ligaments made of aluminum, copper, or silver. The metal ligaments are aligned in a direction substantially parallel to the direction of the heat flowing from the electronic module. The metal ligaments form a network of numerous open cells aligned in the same direction as the ligaments. The metallic foam can be deposited with CVD diamond to maximize conductivity and cooling capability. (Col. 3, lines 5-20 and Col. 4, lines 23-26)

The Ozmat reference fails to disclose an article comprising diamond deposited on a non-metallic framework material substrate having a porosity sufficient to permit the flow of fluids in at least one direction through the material, at least as recited in Claims 1 and 6. The Ozmat reference discloses a metal foam with a metal structure made of a network of metal ligaments or metal wires which form numerous open cells. The metal ligaments provide a higher metal density to provide a lower thermal resistance in the direction of the heat flow, thus being highly conductive.

The Galloway reference teaches a high temperature fluid-to-fluid heat exchanger wherein heat is transferred from a higher temperature fluid flow core region to a lower temperature fluid flow annulus. A porous ceramic foam material occupies a substantial

portion of the annular lower temperature fluid flow region, and is positioned to receive radiated heat from the wall (i.e., radiant heat transfer). The porosity of the ceramic foam material is sufficient to permit a predetermined relatively unrestricted flow rate of fluid (i.e., convective heat transfer) through the lower temperature fluid flow region. (Abstract)

The Saito et al. reference discloses a heatsink that includes a substrate of sintered compact forming a body having holes filled with copper and a thin diamond film layer formed on the substrate. (Col. 6, lines 25-32 and 55-63). The Saito et al. reference discloses that the diamond film of the heatsink permeates (fills and seals) the holes at the surface of the heatsink and that copper is melted into and fills the holes that are present in the porous body of the heatsink. (Col. 20, lines 50-67; Col. 21, lines 1-2, 25-40; and FIG. 20; numerals: porous body 310, holes 311, copper 312, and diamond film 320). The Saito et al. reference discloses a heatsink that utilizes conductive heat transfer to cool semiconductors. The Saito et al. reference is silent as to convective heat transfer using a cooling fluid flowing through the heatsink.

The Herb et al. reference discloses that 5μ fibers of silicon nitride are coated with approximately 25μ of diamond through chemical vapor deposition means. (Col. 10, lines 8-10). The Herb et al. reference discloses a heatsink that utilizes conductive heat transfer to cool. The Herb et al. reference is silent as to convective heat transfer using a cooling fluid flowing through the heatsink.

Argument

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996).

First, it is not possible to substitute the ceramic foam of the Galloway reference for the metal foam of the Ozmat reference. The Ozmat reference teaches making a porous metal foam in which fluid will flow completely through in one direction. Specifically, the metal foam is made in order to significantly improve the thermal capabilities (i.e., the conductive heat transfer) of the foam by aligning the randomly distributed ligaments and cells in a direction parallel to the direction of the heat flux (i.e., the conductive heat transfer) to be removed. (Ozmat, Col. 3, lines 44-50) This alignment of the cells is possible because a metal can be heated and stretched without breaking. This method of aligning the cells is not possible with a ceramic foam, the ceramic foam would shatter. Therefore, one could not substitute the random ceramic foam of the Galloway reference for the metal foam as taught by the Ozmat reference.

If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPEQ 1125 (Fed. Cir. 1984). There is no motivation to combine these references. To substitute the Galloway reference random ceramic foam for the Ozmat reference metal foam would render the Ozmat reference inoperable. The references being combined cannot render the invention unsatisfactory for its intended purpose. The Examiner has failed to make a *prima facie* case of obviousness.

Second, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). The Ozmat reference teaches a different principal of operation than the Galloway reference.

The Ozmat reference teaches a novel heat exchanging foam having a network of metal ligaments for cooling an electronic module by pulling heat away from the module through the metal ligaments and transferring heat in the metal ligaments. (Ozmat, Col. 1, lines 49-55) Metal ligaments are conductive materials. Thus, the Ozmat reference teaches the principle of operation of conductive heat transfer through the metal ligaments.

In contrast, the Galloway reference teaches a ceramic foam block that absorbs heat in the effluent gases exiting the reactor by both convection and radiation. (Galloway, Col. 5, lines 5-8) Ceramic materials are insulators. A metal conductor is not the same as a ceramic insulator. The Galloway reference teaches the principal of convective and

radiant heat transfer to cool. Since the Galloway reference teaches a different principal of operation than the Ozmat reference, there is no motivation to combine, thus there is no *prima facie* case of obviousness.

Third, the Ozmat reference also teaches transferring heat in the metal ligaments to another location by directing a fluid coolant through interconnected voids, which are formed by ligament surfaces. (Ozmat, Col. 1, lines 49-55) In addition to the conductive heat transfer nature of the metal foam, the Ozmat reference also teaches convective heat transfer via a continuous flow of fluid through the entire metal foam. The Ozmat reference teaches the principal of flowing fluid completely through the porous structure.

In contrast, the Galloway reference teaches that the heat exchanger has a narrow gap along the sides of the ceramic foam bricks to allow for the flow of most of the gas. The gases flow along the outer wall and through only the edges of the ceramic foam material. (Galloway, Col. 3, lines 37-68) Thus, the Galloway reference teaches the principal of fluid flow along the walls and partially along the edges of the ceramic foam bricks.

There is no motivation to combine these two references, since the Galloway reference does not teach the elements of the Ozmat reference and teaches a different principal of operation than the Ozmat reference. Therefore, the Examiner has failed to make a *prima facie* case of obviousness.

The combination of the Ozmat reference and the Galloway reference with either the Saito et al. reference or the Herb et al. reference, fails to teach or suggest each and every claimed element. The combination of the prior art does not teach or suggest an

article comprising diamond deposited on a non-metallic framework material substrate having a porosity sufficient to permit the flow of fluids in at least one direction through the material, at least as claimed in amended Claim 1. The addition of the Saito et al. and the Herb et al. references does not remedy the deficiencies of the Ozmat and Galloway references. The Saito et al. and the Herb et al. references teach a solid structure with the pores or holes in the structure filled with a material such that fluid will not flow in at least one direction through the material. The Saito et al. and the Herb et al. references teach a heatsink that utilizes conductive heat transfer, and not convective heat transfer and therefore, would not even suggest the flow of a cooling fluid through the structure.

Additionally, the Office Action has relied upon optimization of ranges as a basis for rejection. Only result-effective variables can be optimized. A particular parameter first must be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 195 USPQ 6 (CCPA 1977). There has been no determination in the Office Action that the thickness of the diamond layer or the void distribution is a result-effective variable as taught in the prior art references.

Identification of prior art statements that, in abstract, appear to suggest claimed limitations does not establish a *prima facie* case of obviousness without finding as to specific understanding or principle within knowledge of skilled artisans that would have motivated one with no knowledge of the invention at issue to make a combination in the manner claimed. *In re Kotzab*, 55 USPQ2d 1314, (Fed. Cir. 2000). The motivation,

suggestion or teaching may come explicitly from statements in the prior art, the knowledge of one of ordinary skill in the art, or, in some cases the nature of the problem to be solved. *In re Kotzab*, 55 USPQ2d 1317, (Fed. Cir. 2000). The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art. *In re Keller*, 208 USPQ 871, 881 (CCPA 1981). Whether the Board relies on an express or an implicit showing, it must provide particular findings related thereto. *In re Kotzab*, 55 USPQ2d 1317, (Fed. Cir. 2000). Broad conclusory statements standing alone are not evidence. *In re Kotzab*, 55 USPQ2d 1317, (Fed. Cir. 2000).

Thus, reliance on the obviousness rejection based upon result-effective variables is not sufficient without evidence from the prior art. It is respectfully requested that evidence be provided, cited from the prior art references to prove that the diamond layer thickness or the voids in the foam are result-effective variables or the rejection must be withdrawn.

Further, the Office Action asserts that the coalescence of the diamond film would have been inherently present in the heat exchanger of the Ozmat reference in view of the Galloway reference as modified by the Saito et al. or Herb et al. references. However, the Office Action has not provided factual and technical grounds establishing that the coalescence of diamond film is inherently necessary as disclosed in the prior art of the Ozmat, the Galloway, and the Saito et al. reference or the Herb et al. reference. Evidence

that the inherency asserted by the Examiner is derived as a necessary conclusion from the prior art, and not simply a possible conclusion, is respectfully requested.

Still further, there is no motivation to combine the prior art references of the Ozmat and Galloway references with the Saito et al. or Herb et al. references. The Ozmat and the Galloway references teach away from the Saito et al. and the Herb et al. references. A factor cutting against a finding of motivation to combine or modify the prior art is when the prior art teaches away from the claimed combination. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that the applicant took. See *In re Gurley*, 31 USPQ 2d 1130 (Fed. Cir. 1994).

The Ozmat reference teaches a heat exchanger that utilizes a cooling fluid flowing completely through an open foam cell structure formed by metal wire ligaments. The Ozmat reference relies on having open cells to allow cooling fluid to completely flow through the heat exchanger to perform cooling through convective heat transfer.

In contrast, both the Saito et al. and the Herb et al. references teach heatsinks that fill the pores and holes in the metal structure in order to enhance conductive heat transfer. The Saito et al. and Herb et al. references teach devices having solid conductive heatsinks are not appropriate for convective heat transfer using a cooling fluid flowing through an open cell structure. As one of ordinary skill in the art understands, convective heat transfer flowing cooling fluid through a heat exchanger is much different than conductive heat transfer through a solid heatsink. One of ordinary skill in the art would be

discouraged from combining the Ozmat reference with the Saito et al. or Herb et al. references. The Examiner has failed to make a *prima facie* case of obviousness.

The argument and evidence set forth above is equally applicable here. If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q. 2d 1596 (Fed. Cir. 1988). Since independent Claims 1 and 6 are nonobvious, then dependent Claims 2, 4, 5, 7, and 9-11 must also be nonobvious.

Reconsideration and withdrawal of this rejection is respectfully requested.

Examiner's Rejection

Claims 3, 8, and 28 stand rejected under 35 U.S.C. § 103 as being allegedly unpatentable over the Ozmat reference, in view of the Galloway reference as applied to Claims 1 and 6, in view of the Saito et al. or Herb et al references. This rejection is respectfully traversed.

In the Office Action, the Examiner states that the combination of the Ozmat and Galloway references do not disclose an intermediate layer between the substrate and diamond film. The Examiner contends that the Saito et al. reference teaches that there is an intermediate SiC layer 32 disposed between the diamond film layer 31 and a porous substrate 26. The Herb et al. reference discloses the substrate being coated with a layer of a second material. The Examiner contends that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have included an intermediate layer between the substrate and the diamond layer motivated by the desire to

improve the adherence between the substrate and the diamond layer. Applicants respectfully disagree with the Examiner's contentions.

Arguments

First, as stated above, for an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996).

As stated above, the Ozmat and Galloway references cannot be combined. This argument applies equally here.

The combination of the Ozmat reference and the Galloway reference with either the Saito et al. reference or the Herb et al. reference, fails to teach or suggest each and every claimed element. The Saito et al. and the Herb et al. references teach a solid structure with the pores or holes in the structure filled with a material such that fluid will not flow in at least one direction through the material. In contrast, Claims 1 and 6 recite

"having a porosity sufficient to permit the flow of fluids in at least one direction through the material" and Claim 28 recites "a contiguous open structure configured for fluid flow in more than one axis through said contiguous open structure". The Saito et al. and the Herb et al. references teach a heatsink that utilizes conductive heat transfer, and not convective heat transfer and therefore, would not even suggest the flow of a cooling fluid through the structure. Therefore, the Examiner has failed to make a *prima facie* case of obviousness.

Second, if an independent claim is non-obvious under 35 U.S.C. 103, then any claim depending therefrom is non-obvious. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). As stated above, Claims 1 and 6 are non-obvious, therefore Claims 3 and 8 are also non-obvious.

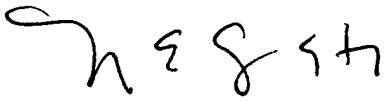
Reconsideration and withdrawal of this rejection is respectfully requested.

Request for Allowance

Entry of this Amendment will place the Application in better condition for allowance, or at the least, narrow any issues for an appeal. Accordingly, entry of this Amendment is appropriate and is respectfully requested.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

Respectfully submitted,
SIERRA PATENT GROUP, LTD.



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